TYPE OF REPORT: Semiannual

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ABSTRACT -- KEY POINTS

BRDF

1) At-launch code tested and integrated at SDST and beyond

2) AVHRR algorithm prototyping data sets prepared (tiling, metadata, EOS-HDF)

3) Excellent results from Jornada field validation comparing ground measurements to AVHRR- and POLDER-derived values of albedo

4) 1 paper appeared in print, 1 paper accepted, 3 submitted with direct relevance to MOD43 BRDF/albedo; 6 papers on BRDF/Albedo at the IGARSS'98 conference

5) Biophysical interpretations of BRDF product studied and links to data users established to prepare early science, work on integrating albedo product parameters into land surface models

Land Cover/Land Cover Change

1) At-launch land cover monthly code was tested and integrated at STST and beyond

2) Algorithm validation continued for land cover in the Central America region

3) Land Cover database acquisition was initiated for North America with an initial focus on New England

4) Land Cover Change sites in Africa were studied to determine the relationship between change metrics and change processes.

5) xxx papers appeared in print, xxx papers were accepted, xxx were

submitted with direct relevance to Land Cover/Change; xxx papers on Land Cover/Change were presented at IGARSS'98.

TASK PROGRESS

BRDF/ALBEDO PRODUCT

Algorithm development
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* Early in the year the version 2 MOD43B BRDF/albedo code was iterated between SDST and the SCF. Updates required mainly concerned metadata source, content and format. Also the code was transitioned from HDF to HDF-EOS. Data generators and tools were transitioned at the same time.

* The code ran for the first time on a full MODIS tile, 1200km by 1200km. This test, using synthetic L1B data passed through all upstream algorithms, passed without any problems. 16 days of data were used.

* The code is being implemented at University College London for extensive pre-launch testing.

* An extensive "user guide" for the MOD43 algorithm was written.

* A new post-doc joined the coding effort at 1/4 time and was initiated.

* BU was linked to the VBNS to Washington, which has greatly improved data transfer rates from the TLCF to the BU SCF.

* We have started creating QA tools by getting the tools being developed by the LDOPE to run, test and expand them.

* AVHRR data sets were tiled in MODIS-fashion to begin prototyping and algorithm testing with real data.

* We were involved in the certification test planning.

Scientific advances
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* A polynomial representation of the solar zenith angle dependence of black-sky albedo was developed that allows more efficient use of our data product parameters without recourse to the BRDF model used.

* We investigated Liang's spectral-to-broadband conversion coefficients for the MODIS bands (Liang at al., 1998) and found them to perform a satisfactory job so that they can be used in the algorithm.

* We investigated biophysical interpretations of the BRDFs retrieved from our New England prototype study by correlating BRDF properties with surface features seen in Landsat data. Ongoing.

* The previous study of 18 days of AVHRR and GOES-8 1km data over New England will be extended to 6 months. Acquisition of these data and their geolocation is under way and will be automated once understood. This will allow us to study seasonal variations. Furthermore, we have acquired Landsat TM imagery of the same region and geocoded it to the BRDF inversions for a detailed study of land surface-BRDF dependencies. Status: geolocation and cloud clearing have been completed.

* A plant modeling ray tracing tool that has been completed at University College London (P. Lewis) is being used to study the relationship between biophysical parameters such as LAI and the MODIS BRDF model parameters. Indications are that these models, although semiempirical, produce parameters that are correlated with the physics of the scene. Status: results show a clear biophysical interpretation behind the model parameters

* ASAS data for the HAPEX-Sahel region were processed to define a prototype BRDF for sparse canopies for use in the at-launch BRDF database required by the algorithm. SCAR-B data were processed to do the same for a cerrado scene (sparse open brushland) and a rainforest scene

* 1km AVHRR data of North and Central America from June 1995 were investigated as to their suitability for BRDF inversions; a project using these data was started by transforming the data into a format that corresponds to the MOD_AGG format.

* Strahler and Lucht attended the ISLSCP Science Panel Meeting in Paris in May to interface with land surface modelers, giving a talk on the MODIS albedo product and making connections with users.

Validation activities
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* A mixture model was derived from correlating areal proportions over cover component types from the hemispherical photography taken during the Jornada PROVE field campaign with the corresponding albedometer measurements taken ata the same site. Using newly acquired stationary albedometer data of the same site from the MISR team a solar zenith angle correction was performed as well as a soil moisture correction. The field-observed broadband albedos were compared to albedos derived from spectral AVHRR and from POLDER observations, respectively using the MODIS BRDF model and AVIRIS spectra for spectral extrapolation. The

agreement between albedos derived from the space-based measurements and those observed on the ground is excellent (deviations are within a few percent). This validates our validation approach.

* We investigated whether it would be feasible to put an albedometer onto the light aircraft package to be flown post-launch in MODLAND Quick Look campaigns, coordinated by A. Huete. We will try to achieve this. Kipp+Zonen CM21-Instruments have been ordered for this purpose.

* The requirements document for radiometric validation to guide the new EOS validation investigators with respect to MODIS and MISR data products was drafted and submitted to other team members. Status: nearly complete.

* We had extensive discussions with Shunlin Liang, the albedo validation scientist, about albedo validation. He is using MODLAND-owned albedometers and dataloggers, which we provided him with, and is planning a campaign at the USDA-BARC in August in which we will participate. Light aircraft overflights are scheduled.

Publication/talks activity
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* A key paper on BRDF/albedo retrieval accuracy has appeared:

Lucht, W. Expected retrieval accuracies of bidirectional reflectance and albedo from EOS-MODIS and MISR angular sampling J. Geophys. Res., 103, 8763-8778, 1998.

* A paper on the coupling between surface BRDF and atmospheric correction was accepted for publication by IEEE TGARS:

Hu, B., W. Lucht, and A. H. Strahler. The interrelationship of atmospheric correction of reflectances and surface BRDF retrieval: A sensitivity study IEEE Trans. Geosci. Remote Sens., in press, 1998.

* A paper on BRDF-corrected NDVI and albedo from AVHRR observations over South America was submitted to RSE:

Hu, B., W. Lucht, A. Strahler, C. Schaaf, and M. Smith. Surface albedos and angle-corrected NDVI from AVHRR observations over South America

* A paper on the noise sensitivity of MODIS BRDF/albedo retrievals was submitted to IJRS:

Lucht, W., and P. Lewis. Theoretical noise sensitivity of BRDF and albedo retrieval from the EOS-MODIS and MISR sensors with respect to angular sampling

* A paper on prototyping of the MODIS BRDF/albedo algorithm was resubmitted to the EOS special issue of JGR:

d'Entremont, R. E., C. L. Barker Schaaf, W. Lucht, and Alan H. Strahler. Retrieval of red spectral albedo and bidirectional reflectance from 1-km**2 satellite observations for the New England region

* 6 papers were published as part of the IGARSS'98 proceedings that are closely related to the MODIS BRDF/albedo product:

Lucht, W., C. B. Schaaf, A. H. Strahler, J.-P. Muller, B. Hu, P. Lewis, Y. Liu, A. H. Hyman, X. Li, M. J. Barnsley, N. C. Strugnell, and R. P. d'Entremont, At-launch status of the MODIS BRDF/albedo algorithm: implementation, AVHRR-based prototyping, and future plans, Proc. Int. Geosci. Rem. Sens. Symp. 98, in press, 1998.

Gao, F., X. Li, W. Lucht, A. H. Strahler, and Z. G. Xia, Retrieving albedo in small sample size, Proc. Int. Geosci. Rem. Sens. Symp. 98, in press, 1998.

Schaaf, C. B., W. Lucht, R. P. d'Entremont, and A. H. Strahler, Relationship between land surface properties and BRDF/albedo parameters using satellite data, Proc. Int. Geosci. Rem. Sens. Symp. 98, in press, 1998.

Hyman, A. H., W. Lucht , M. J. Barnsley, J.-P. Muller, P. Hobson, and A. H. Strahler, Investigations of the spatial variability of albedo during the Grassland PROVE '97 Jornada field campaign, Proc. Int. Geosci. Rem. Sens. Symp. 98, in press, 1998.

Hu, B., W. Lucht, C. B. Schaaf, A. H. Strahler, and M. Smith, Albedos and angle-corrected NDVI for the Brazilian LBA study area from AVHRR multiangular reflectance inversions, Proc. Int. Geosci. Rem. Sens. Symp. 98, in press, 1998.

Strugnell, N., W. Lucht, A. H. Hyman, and G. Meister, Continental-scale albedo inferred from land cover class, field observations of typical BRDFs and AVHRR data, Proc. Int. Geosci. Rem. Sens. Symp. 98, in press, 1998.

LAND COVER/LAND COVER CHANGE

Test Sites and Test Site Activities

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* We continued research on neural net classifiers focusing on operational processing scenarios. We continued processing of AVHRR, TM and ancillary data for this regional test site, and development of a land surface parameter database.

* We completed the development and documentation of our validation and test site database.

* We conducted field research in New England to develop an operational training, testing and validation database, generating some 200 sites.

Algorithm Development and Testing

* We continued research on neural net classifiers focusing on operational processing scenarios.

* We continued processing of AVHRR, TM and ancillary data for the Central America regional test site, and development of a land surface parameter database.

Coding/Processing

* The MODIS code was revised to incorporate HDF-EOS and to implement ECS mandated changes to the metadata. We expended some effort on tools for reprojecting to the MODIS Integerized Sinusoidal Grid. We have also been developing tools, scripts and code for integrating our site train/test data with MODIS data, currently using AVHRR as a surrogate.

DAAC Activities

* BU continues to test communications links with the EDC-DAAC

Land Cover Change

* Jordan Borak of BU spent four weeks working with Eric Lambin at the University of Louvain on change detection algorithm testing in Africa.

Participation in MODIS Activities

* IGBP-DIS Landcover Validation Workshop; Group Workshop at UC Santa Barbara (Strahler/Muchoney); 1-3 February 1998; UC Santa Barbara

* MODIS Science Team meeting; 11-13 February 1998; GSFC

Publication/talks activity
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* 6 papers related to the MODIS Land Cover/Land-Cover Change product were submitted to journals:

Borak, J.S., Lambin, E.F. & Strahler, A.H. Use of temporal metrics for land-cover change detection at coarse spatial scales in Africa. International Journal of Remote Sensing, 1988.

Friedl, M.A., C. E. Brodley, and A. H. Strahler. Maximizing land cover classification accuracies produced by decision trees at continental to global scales, IEEE Trans. Geosci. Remote Sens., 1998.

Gopal, S., C. Woodcock, and A. Strahler. Fuzzy ARTMAP classification of global land cover from the 1 degree AVHRR data set. Remote Sensing of Environment, 1998.

Muchoney. D.M., J. Borak, H. Chi, M. Friedl, J. Hodges, N. Morrow and A. Strahler. Application of the MODIS Global Supervised Classification Model to Vegetation and Land Cover Mapping of Central America. International Journal of Remote Sensing, 1998.

Muchoney, D.M., and A. Strahler. Development of a Global Site Land Surface Parameter Site Database for Vegetation and Land Cover, Part 2: The System for Terrestrial Ecosystem Parameterization. Remote Sensing of Environment, 1998

Muchoney, D.M., and A. Strahler. Development of a Global Site Land Surface Parameter Site Database for Vegetation and Land Cover, Part 2: The System for Terrestrial Ecosystem Parameterization. Remote Sensing of Environment, 1998.

* 1 abstract was submitted to the American Institure of Biological Sciences 49th Annual Meeting, Baltiumore, MD, 2-6 August 1998:

Muchoney, D.M., and A. Strahler. Generation of surface biophysical parameters for global vegetation and land cover characterization using MODIS data.

* 2 papers were published as part of the IGARSS'98 proceedings that are closely related to the MODIS Land Cover/Land-Cover Change product:

Muchoney. D.M., and A. Strahler. Developing Vegetation and Land Surface Parameters Using Classification Approaches. Proc. Int. Geosci. Rem. Sens. Symp. 98, in press, 1998.

Borak, J.S., Lambin, E.F. & Strahler, A.H. Detection and validation of land-cover change at coarse spatial scales in Africa. Proc. Int. Geosci. Rem. Sens. Symp. 98, in press, 1998.

ANTICIPATED ACTIVITIES DURING THE NEXT QUARTER

BRDF/ALBEDO

* Prepare a paper on how to use the MOD43 BRDF parameters in land surface albedo modeling and summarizing the accuracy studies conducted

* Make progress on data product visualization and QA tools

* Make progress on prototyping data set preparation from the AVHRR

* Participate in a field campaign on albedo

* Continue discussions with land surface modelers on early science

LAND COVER/LAND COVER CHANGE

* Work will continue to focus on test site/land surface parameter extraction and algorithm testing in North America. Classification algorithm development and testing will focus on the operational aspects (process, flow) of neural net and decision trees classifiers.

* In land cover change activities, we will continue testing of change vector and neural network change detection techniques at specific sites to complement the multitemporal nature of the land cover activities. We will continue site activities using the 1-km NDVI dataset for the western hemisphere and especially Central America.

* We will participate in the IGBP Core Validation Exercise at USGS-EDC, Sioux Falls from 6-14 September

* We will host a meeting with David Roy to discuss LC QA plans in August.

PROBLEMS/CORRECTIVE ACTIONS

* None